FACTS

Ontario
Ministry of the Environment

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COUNTDOWN
ACID
RAIN

ABOUT ACIDIC PRECIPITATION AND THE NEED FOR REMEDIAL ACTION

What is Acidic Rain?

Natural rain is slightly acidic. It dissolves atmospheric carbon dioxide to form weak carbonic acid. Rain is also affected by natural air pollution from volcanoes, sea spray, and blowing soil.

However, acid rain is frequently much more acidic than normal because of sulphur and nitrogen oxide pollution.

Coal and oil burning, ore smelting, industrial furnaces and petroleum refining all create sulphur pollution. Vehicle exhausts and fossil-fueled power plants emit nitrogen pollution.

A 1983 U.S.-Canada report shows that human activity caused 50 million tonnes of acid air pollution in 1980. The U.S. produced 43.4 million tonnes and Canada emitted 6.6 million tonnes.

How is Acidity Measured?

The acid level of a solution is measured in pH units on a scale from 0 to 14. The lower the number, the more acidic the solution. A pH of 7.0 is neutral, neither acidic nor alkaline. A decrease of one unit represents a ten-fold change in the acid content. For example, a lake that measures pH 6.0 contains ten times more acid than a lake with a pH of 7.0. Pure water, in equilibrium with carbon dioxide in the atmosphere has a pH of about 5.6. Therefore 5.6 is regarded as the value which rainfall will have in the absence of other chemical influences.

Major Man-made Sources of SO_2 and NO_x (million tonnes – 1980)*

Sulphur Emissions (SO_2)

	U.S.	Can.	
Total	24.1	4.8	28.9
Electrical Utilities	15.8	0.75	16.55
Non-Ferrous Smelters	1.4	2.13	3.53
Other – Mainly Industrial	6.9	1.91	8.81

Nitrogen Emissions (NO_x)

	U.S.	Can.	
Total	19.3	1.83	21.13
Electrical Utilities	5.6	0.25	5.85
Transportation	8.5	1.11	9.61
Other Combustion	5.2	0.47	5.67

*Source of Estimates 1983 Canada-U.S. Memorandum of Intent 3B Final Report.
Note: Total may not add up due to rounding.

The pH of polluted rainfall may be as low as 3.0. That's 400 times more acidic than normal rainfall.

In Ontario, acid rain has increased to the point where the average pH of rainfall south of the 50th parallel is less than 5.0. The average, annual pH of rain in southern Ontario is 4.1.

Acidic precipitation evolves in three stages. First there are sulphur and nitrogen emissions. Then long-range atmospheric transport allows the transformation of oxides into acid. Finally the precipitation falls to earth in rain, snow, dry particulates, ash or gases.

Where Does Acid Rain Come From?

Environment Ontario can calculate the origin of polluted rain or snow and determine its acid concentration. Fifty per cent of the sulphate affecting Ontario originates in the heart of the United States. Another 20 per cent is defined as "background" pollution and comes from other natural and man made sources around the world.

Much acid rain is carried into Ontario by moist air which originates over the Gulf of Mexico. This air collects pollution as it moves north over the industrialized heartland of the United States. When this damp air cools it forms clouds. The clouds turn into rain and dump much pollution, on Ontario, in the form of acid rain or snow.

What Areas are Affected?

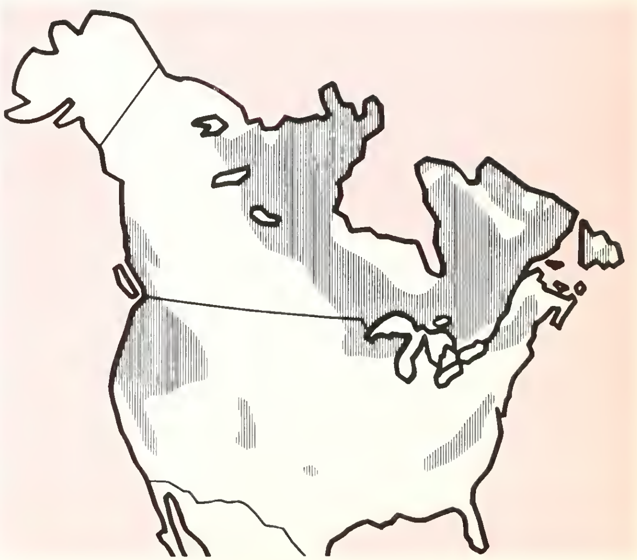
In parts of southern Ontario limestone in the soil helps protect the lower Great Lakes by neutralizing acid rain. But lakes on the Precambrian Shield easily become acidic. This is because the shield is composed of quartzite or granite rocks and has very little soil. These materials haven't enough buffering capacity to neutralize even small amounts of acid rain. So the runoff water in lakes and rivers on the shield become acidic.

Environment Ontario, in co-operation with the Ministry of Natural Resources, conducts lake surveys to determine the sensitivity of Ontario lakes to acidic rain. M.O.E.'s fourth survey report, published in 1985, listed 5,341 lakes. Four per cent (220 lakes) were acidified so much that their ability to support aquatic life was severely limited. Sixty-eight per cent (3,753 lakes) were susceptible to acidification. Only one-quarter (1,368 lakes) of the lakes were not sensitive to the cumulative effects of acid rain.

Why is Acidic Precipitation a Problem?

Acidic precipitation, threatens many fish species by disrupting spawning. It can also kill the aquatic life on which fish depend for food. In waters with a pH of 5.5 or less, there can be deterioration of sports fish populations.

North American Areas Containing Lakes Sensitive to Acid Precipitation



Sports fish may be destroyed by acid shock during spring run-off, when the pollutant-laden snow suddenly melts into waterways. Heavy rain storms can also cause acid shock. This can happen in lakes which are not acidic in summer.

Acid rain leaches natural metals, such as aluminum, manganese and iron from the soil. They can poison fish, and toxic metals, such as mercury, cadmium and lead, are found in high concentrations in fish from acidic lakes. These metals can make fish unfit for human consumption.

Acid rain affects forests, vegetation, paints, buildings, structures and historical statuary.

The damage documented in Ontario, north-eastern North America, Europe and Asia, shows the need for quick abatement action. The world-wide use of energy has increased greatly since the end of the Second World War. Special control measures are necessary to reduce fossil fuel emissions to prevent what may be irreversible damage to the environment.

International Action Needed

Environment Ontario has involved federal agencies in both Canada and the United States in the search for solutions to the acid rain problem and is participating in the drive to establish international abatement programs.

On August 5, 1980, Canada and the United States signed a Memorandum of Intent (M.O.I.) on transboundary air pollution, the intent being to vigorously enforce existing air pollution legislation and to work toward the development of a bilateral agreement on air quality.

To support the M.O.I., Ontario issued regulations to Inco in Sudbury and Ontario Hydro's electrical utility plants. These 1980-81 regulations were the first in North America to require stringent emission reductions solely for long-range transport reasons. Inco and Hydro had already met local air quality standards.

Ontario has now committed to further reductions as described in the attached documents. By comparison, the U.S. has not adopted any controls on SO_2 emissions from existing facilities to reduce long-range damage caused by acid rain. In fact, limits on some emissions have been relaxed significantly.

Summary of Canada/U.S. Negotiations

The Memorandum of Intent established a Co-ordinating Committee to negotiate a collective agreement on transboundary air pollution. Five Technical Work Groups assisted in the negotiations by providing reports to form the basis for the agreement. The province has been an active participant in the work groups.

In February of 1982, Canada proposed to reduce sulphur dioxide emissions by 50 per cent east of the Manitoba-Saskatchewan border, contingent on parallel action in the eastern U.S. There was no response from the U.S. members.

Then in June, 1982, the U.S. representatives rejected Canada's proposal, citing lack of scientific evidence as the reason. There have been no official negotiating meetings since then.

In February, 1983, the final reports of the Technical Work Groups were released.

The report issued by the Impact Assessment Work Group had a Canadian and a U.S. version. The Canadian version recommended a maximum level of 20 kilograms per hectare per year (18 lbs. per acre per year) of wet sulphate deposition to protect all but extremely sensitive aquatic systems.

Separate Canadian/U.S. peer reviews of the reports were conducted. In July, 1983 the Canadian Peer Review Report concluded that scientific evidence was sufficient to warrant prompt introduction of abatement measures.

International 30 Per Cent Club Established

Because of dying lakes and forests, environment ministers from Canada and nine European countries met in Ottawa on March 20 and 21, 1984, and signed an acid rain accord pledging to reduce annual sulphur dioxide emissions by at least 30 per cent by 1993. The declaration also promises that each nation will decrease emissions of nitrogen oxides. Countries, such as Sweden, have already made a 50 per cent cut and are making the 30 per cent cut too because they fear the damage from acid rain may be irreversible.

In June of 1984, another eight countries joined the Club with five of the new members coming from Eastern Europe. Two more countries joined in September of 1984. There are now 20 countries in the 30 Per Cent Club. The commitment made by these countries attests to the seriousness of the issue. The onus to justify inaction is clearly on the two major polluting nations who to date have not joined the club. They are the United States and Great Britain.

Ontario Provincial Reports For Additional Information On Acid Rain:

Acid Sensitivity of Lakes in Ontario. 1985. Ontario Ministry of the Environment.

Acidic Precipitation in Ontario Study. Annual Program Report Fiscal Year 1984/1985. APIOS Report No. 023/85.

Acidic Precipitation in Ontario Study. Summary of Research Results and List of Publications. Prepared for the Muskoka Conference '85, September 15-20, 1985.

The Economics of Acid Precipitation: A Review of Socio-Economic Methods to Assess Acid Deposition Effects. APIOS Report No. 006/84. Reprinted July 1985.

Sugar Maple Decline in Ontario. APIOS Report No. 026/85.

Summary Report. International Symposium on Acidic Precipitation. Muskoka, Ontario, Canada. 1985. September 24, 1985.

Synopsis: Impact of Sudbury Smelters on Wet and Dry Deposition of Acidicity and Sulfates in Ontario. October 1984.

Target Loadings to Protect Surface Waters. Presentation to the Air Pollution Control Association. Edmonton, Alberta. May 15, 1984.

Water Quality Changes in Sudbury Area Lakes, 1974-1976 to 1981-1983. APIOS Report No. 007/85.